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External environmental assessments at the test and evaluation centers : the first step towards strategic planning

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THESIS

EXTERNAL ENVIRONMENTAL ASSESSMENTS AT THE TEST AND EVALUATION CENTERS: THE FIRST STEP TOWARDS STRATEGIC PLANNING

by

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This thesis examines external environmental assessments conducted at three DoD test centers. It finds that these assessments are not as well developed as they could be and that only superficial examinations of the organizations opportunities and threats have been attempted. Recommendations for improving the test centers external environmental assessments as part of their Strategic Planning and management efforts are offered.

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EXTERNAL ENVIRONMENTAL ASSESSMENTS AT THE TEST AND EVALUATION CENTERS: THE FIRST STEP TOWARDS STRATEGIC PLANNING

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ABSTRACT

This thesis examines external environmental assessments conducted at three DoD test centers. It finds that these assessments are not as well developed as they could be and that only superficial examinations of the organizations opportunities and threats have been attempted. Recommendations for improving the test centers external environmental assessments as part of their strategic planning and management efforts are offered.

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I. INTRODUCTION

A. PURPOSE

The purpose of this research is to determine the extent to which the Army's test and evaluation centers external environmental assessment processes are adequate. Are their external environmental assessments capturing the trends and forces shaping the changing acquisition environment?

B. RESEARCH QUESTIONS

The research addresses a primary research question, as well as several secondary questions. The primary question is: To what extent do existing external environmental assessment efforts at the Army's test centers adequately map the general and task environment?

The secondary questions are:

(1) What is the potential environment for the Army's test centers? What are the emerging trends and forces, and what issues need to be considered?

(2) What external environmental data should be collected and considered? Are there any significant threats or opportunities that are not being addressed by the test centers?

C. SCOPE AND METHODOLOGY

This thesis includes an analysis of the current strategic planning efforts at three test centers in the Army's Test and Evaluation Command, specifically their

environmental assessments. These test centers have been selected to represent not only a broad cross section of the Army's technical test mission, but also to reflect a portion of DoD's Major Range Test Facility Base (MRTFB). The thesis examines the environmental factors affecting these test centers and address trends in emerging test and evaluation requirements. It also includes a review of the test center asessments. Recommendations to improve the environmental assessments conclude the thesis.

The objective of this thesis is to identify whether or not current test center strategic planning at three of the Army's test centers is responsive to the changing environment. To accomplish this, descriptions of the test centers and their environmental assessments are presented. Next, an independent assessment is conducted which relies on test center workload information, strategic plan reviews, management interviews, and policy reviews. Analysis of the data suggests that environmental assessments at all the test centers are inadequate.

The methodology used in this research consisted of the following steps:

(1) Conduct a literature search of books, magazine articles, CD-ROM systems, and other library information resources regarding external environmental assessments.

(2) Interview Army Program managers to assess changing customer requirements.

(3) Identify environmental factors affecting the Army's test centers.

(4) Obtain historical organizational, workload, and funding data from the test centers.

(5) Obtain and review business and strategic plans from the test centers and TECOM.

(6) Examine historical data and factors for trends.

(7) Evaluate the impact of reforms and requirements on test center business environment.

(8) Identify current external environmental assessment activities and the information they generate.

(9) Develop an independent external environmental assessment.

(10) Compare the test centers' environmental assessments with an independent assessment.

(11) Develop recommendations to correct any gaps in the test centers' external environmental assessments.

D. ORGANIZATION OF THE STUDY

Chapter II provides an overview of strategic planning to describe how external assessments fit in the strategic planning process. The chapter concludes with a detailed description of why external environmental analysis are important and how they should be conducted.

Chapter III describes the methodology and rationale for selecting specific test centers. The chapter also provides descriptions of the interviewees—their positions and their influence on the test centers. It also includes a description of the missions for each of the three test centers, personnel make up, operating budgets, and levels of technology. A brief description of the Army's Test and Evaluation Command (TECOM) is also provided.

Chapter IV presents the results and data obtained from the test centers regarding their external assessment process and data collection efforts. These data include reviews of their strategic and business plans, and interviews with key strategic management personnel. The chapter describes both the formal and informal assessment efforts.

Chapter V offers an independent assessment of the environmental assessments at the test centers. Identification of emerging business trends, such as changes in policies,

acquisition reform impacts, and financial trends sets up points of comparison between what the test centers are doing and what they ideally could be doing.

Chapter VI concludes the thesis with direct answers to the primary and secondary research questions. Areas for further research at the Army's test centers are identified.

E. EXPECTED BENEFITS OF THE STUDY

This study offers recommendations to improve environmental assessments at the Army's Test and Evaluation Command test centers. It focuses on an important first step in the strategic planning process for DoD test organizations seeking to meet the challenges of changing test support requirements.

II. LITERATURE REVIEW

A. INTRODUCTION

This chapter provides an overview of strategic planning and embeds environmental assessments within the larger process. It begins by providing a brief history on the importance of strategic planning and then describes the overall strategic planning process. It closes by detailing the purpose, procedures, outcomes, and significant issues of conducting environmental assessments.

B. STRATEGIC PLANNING AND ENVIRONMENTAL ASSESSMENTS

The term "strategy" is derived from the Greek word "strategos," which means "general of the army". In ancient Greece, each tribe elected strategos who then formed a council to advise political rulers on how to win wars. Over time, the responsibilities of the strategos' council grew to include advising on civil management issues. These were the roots of strategic planning in today's businesses. [Ref. 1]

As early as 1920, models like the Harvard Policy Model were developed to provide industry with strategic planning tools. These early models maintained direct relationships between a business strategy and its internal operations. But as business management processes matured during the late 1950s, the focus of strategic planning from the inside to external factors such as risk management, industry growth and market share. [Ref. 3] This next generation of models led to strategic decision making based on an analysis of both the internal and external environments. This new generation of models attempted to match an organization's internal strengths with its external

opportunities. During the 1960s, this generation of models became standard management tools for many corporations. [Ref. 3]

What, exactly, is strategic planning? There seem to be as many definitions and models for strategic planning as there are web sites for strategic management consultants. But John Bryson [Ref. 4:p. 21] seems to sum them all up in one quote from hockey great Wayne Gretsky, who said, "*I try to skate to where I think the puck will be.*" In this remark, Gretsky implies that he continuously evaluated all the players in the game and constantly re-positioned himself to where he thought the puck would end up. Metaphorically speaking, Gretsky followed a simple strategic planning process that closely parallels that of today's business organizations trying to stay competitive and sustain growth. Businesses today must evaluate their environment and plan to position themselves to be successful in the future environment. However, unlike hockey, the business environment is much more subjective and requires a systematic, thorough, and analytical planning approach to identify critical factors and develop strategic options. Dr. Berwyn Jones defines strategic planning in the government as:

> the identification of a desired long-range outcome and the development of a sequence of actions to achieve it, based on analysis of the organization's resources and its environment. [Ref. 5]

Why is strategic planning important? Ronald Gunn provides one view of the advantages of strategic planning [Ref. 6]. He identifies six different benefits a strategic plan can provide if it is well thought out and includes input from all stakeholders. These benefits are:

(1) *Establishing Priorities.* The strategic planning process allows an organization to define objectives that are the most critical and need to be the focus of its key programs. Therefore, the process focuses attention on the crucial issues and challenges the organization must face.

(2) *Doing proactive problem solving.* The strategic planning process allows the organization to anticipate problems and take proactive steps to reduce any negative impact.

(3) *Developing a commitment to a common purpose.* The strategic planning process builds commitment throughout the organization to a common set of goals.

(4) *Setting organizational direction.* The strategic planning process provides a direction for the organization and its employees to follow.

(5) *Setting the stage for effective decision-making.* The strategic planning process ensures consistency in the allocation of the organizations resources.

(6) *Keeping management "light on their feet."* The strategic planning process promotes strategic thought and action. From this evolves a mental framework for constant re-assessment when unexpected environmental changes occur. This promotes a learning process that leads to a clearer understanding of organizational issues and the recognition of emerging environmental changes.

Executed properly, strategic planning will yield valuable information and can provide some of the benefits identified by Gunn, although it cannot guarantee any of them. If strategic planning is not implemented carefully and with complete commitment, the process can be a waste of time and money. Bryson warns that strategic planning cannot be substituted for true leadership and that, without a leader and champion, the implementation of any strategies is likely to fail. [Ref 4]

Jones points out that, although strategic planning is easiest to do in a stable environment, it is most useful when the environment is unstable. He draws an analogy between strategic planning and a sailor in a stormy sea: the sailor must constantly reassess his position and adjust his heading to make progress towards his destination (while minimizing the risk of capsizing.) Just as Jones's sailor can't make progress without knowing his destination, an organization must have a clear understanding of its vision and strategy before sailing off. After all, "anyone can steer the ship when the sea is calm." [Ref. 5]

Bryson describes a detailed eight-step systems model for strategic planning. [There are actually ten steps in Bryson's complete model, but since the model encompasses a large number of organizational issues, he recommends tailoring the model for specific applications. For the purposes of this thesis, one optional step is omitted, and two others are consolidated.] Figure 1 depicts a simplified summary version of the model. The model reflects a total strategic planning process that incorporates a rigorously thorough approach. Each of the eight steps recommended by Bryson is summarized and outlined here. [Ref. 4] Step four represents the environmental assessments phase of strategic planning critical to this thesis. An expanded description of the external environmental assessment is provided in Section B of this chapter.

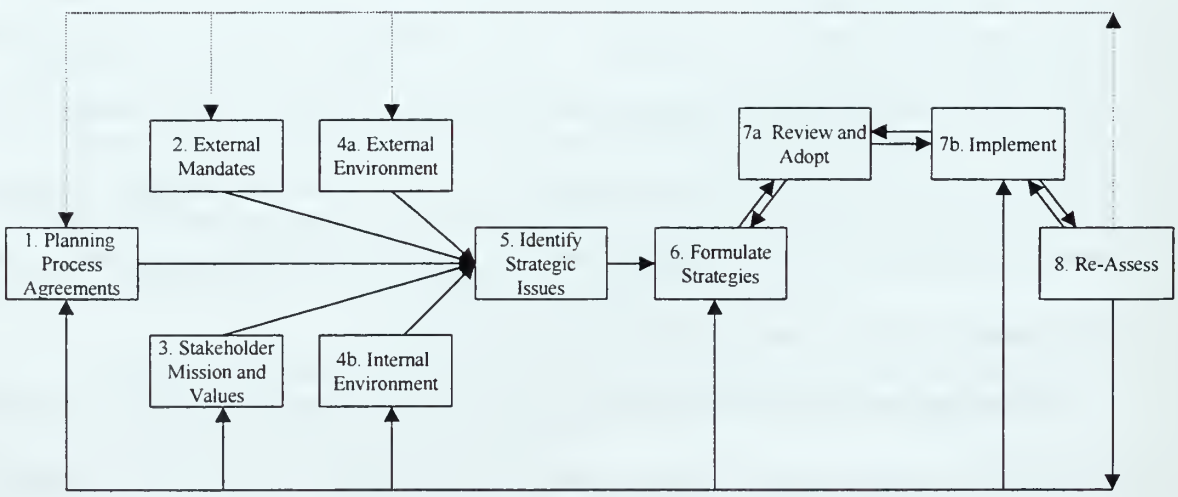

Figure 1. Strategy Change Cycle [Adapted from Ref. 4]

Step 1. *Initiate and agree upon a strategic planning process.* Completion of this step allows high-level decision-makers to agree on critical aspects of the planning effort. Critical aspects that would typically be addressed during this step include schedule of key events, membership of teams, and demonstration of commitment.

Step 2. *Identify organizational mandates.* This step requires the planning team to identify the formal and informal mandates placed on the organization. This phase is essential in determining the constraints and limitations within which the teams must work.

Step 3. *Clarify organizational mission and values.* This step requires the team to conduct a stakeholder analysis to help them write or refine the organizations mission statement, which clarifies the organizations purpose. An organizations values, which clarifies the organizational core philosophy or integrity are also developed during this step. An organizations mission and values, when combined with the organizational mandates, provide the justification for the organization's existence.

Step 4. *Assess the organization's external and internal environments.* This step requires a thorough review of the factors both inside and outside the organization. The result of the analysis is a thorough understanding of the organization's internal strengths and weaknesses, as well as its external threats and opportunities. The external assessment portion of this step is the focus of this thesis and an expanded description is provided at section B of this chapter.

Step 5. *Identify the strategic issues facing the organization.* As depicted in Figure 1, each of the first four steps leads into this phase. During this phase, the team attempts to identify the "critical challenges" and fundamental policy questions that will affect the organization's future. As specific issues are identified, they must be connected back to the mandates and environment, as well as to any consequences of not addressing the issue.

Step 6. *Formulate strategies to manage these issues and facilitate.* During this step, actions, resource allocations, policies or programs are designed to address the strategic issues identified in step 5.

Step 7. *Review and adopt the strategic plans.* This step allows all personnel to review and comment on the team's efforts. Modifications are discussed and incorporated prior to implementation approval.

Step 8. *Reassess strategies and the strategic process.* During this step, the team addresses the implementation of the strategies and whether or not they are successful and should be continued. This assessment should also address the strategic planning process to improve the next round of planning.

C. EXTERNAL ENVIRONMENTAL ASSESSMENTS

1. Introduction.

What is the "external environment"? The external environment includes all the forces outside an organization that can influence its effectiveness or impact its future performance [Ref. 7]. These forces consist of those conditions and trends thrust upon an organization from the outside over which they have limited direct control. The external environment can be divided into two categories; the general environment and the specific task environment.

Carson describes the general environment as consisting of "the broad conditions and trends in the societies within which the organization functions" [Ref. 7]. Carson and Bryson both depict at least four significant elements within the general environment; political, economic, social, and technical [Ref. 4 and 7]. These elements provide the

basis for an assessment of the general external environment described in section B.2 below.

The specific task environment consists of those conditions and trends peculiar to the specific organization and its work. Bryson breaks the task environment into the categories of resource controllers and competitors and collaborators [Ref 7]. Resource controllers include any external factors that can influence the organizations access to funds, personnel or equipment. The task environment also includes the relationships an organization has with its competitors and collaborators. The relationships with external resource controllers, competitors and collaborators should be evaluated and assessed in terms of the threats and opportunities they present. An assessment of these relationships can expose threats (or opportunities) that can not be readily identified during analysis of the general trends and forces.

Why is the external environment important? The output of an external environmental assessment is the identification of the threats and opportunities facing an organization. These opportunities and threats set the stage for identification of strategic issues and are ultimately the foundation for an organizations strategic planning effort. During this effort, organizational members attempt to match their strengths and weaknesses to opportunities and threats in order to meet the anticipated changes. In Bryson's view, without a detailed environmental assessment, an organizations effort to develop effective strategic plans will likely be unsuccessful [Ref. 4]. If the external environmental assessment is poorly developed or not performed at all, then the entire strategic planning effort can be not only a waste of time and money but may also incorrectly allocate organizational resources. This misallocation could result in a more

rapid loss of any existing competitive advantage. Without strong external environmental assessments, an organization cannot develop effective strategic plans and in the long term, cannot remain effective, efficient or competitive.

When should an external environmental assessment be conducted? The process of conducting research, gathering data, and analyzing emerging trends in the external environment is often referred to as "scanning." Bryson considers environmental scanning to be the first "proactive" step in an organization's process of understanding and adapting to a changing environment [Ref. 4]. Environmental scanning should be performed before any attempt to identify opportunities and weakness is made and certainly before strategies and strategic issues are identified. In fact, scanning the continuously environment is ideal. Conducting environmental assessments periodically runs the risk of missing critical information until it is too late.

2. Assessments of General External Environmental

How do you conduct an external environmental assessment? A conceptual model, provided by George Steiner, identifies three basic steps that comprise the external audit process [Ref. 8]. By combining Bryson's and Carson's general environmental elements within these steps, a methodical and structured assessment approach can be derived. The steps to this approach are outlined here:

Step 1. *Analyze the customers.* Obtain detailed information regarding who the industry customers are and why they buy the industries products or services. The analysis should include an assessment of how customer preferences, attitudes and

purchasing habits are changing. Finally, the analysis should explore opportunities to attract potential customers or markets.

Step 2. *Analyze the industry.* Identify the trends and forces influencing the industry in the key general environment areas of; political, economics, social, and technological. Then determine how they are effecting the organization. A more detailed description of the types of information required for each element of the general environment is provided here.

a. Political. The political element includes the changing political system and policies in which the organization must operate and the pressures and processes that influence the way they operate. For instance government regulations may have significant influence on some organizations and increased lobbying for changing regulations may reflect an external force on the organization.

b. Economics. The economic element includes the current system of producing and distributing an organizations products or services. Some of the critical factors for any industrial business could be market trends, inflation factors, or interest rates.

c. Social. The social element includes the norms, beliefs, and behaviors associated with the demographics of a society. For instance, the aging of the baby boomer group has a significant influence on many businesses.

d. Technological. Technological elements evolve through breakthroughs in the industry that can change the ability of an organization to meet customer requirements and demands. For instance, the development of miniaturized electronics has had considerable influence on the entertainment industry.

Step 3. *Analyze the information.* A complete analysis of the information collected in steps one and two will identify the resulting opportunities and threats relative to the organization. This analysis is critical to the assessment process and produces the final product used to match organizational strengths and weaknesses and identification of strategic issues.

Carson recommends information derived from general audits, like this, be analyzed further to improve their usefulness towards identification of priorities and strategies. He supports using an "External Factor Evaluation Matrix (EFE)" described by Smith and Gannon to quantify the effect of the threats and opportunities on organizational success. This quantification should allow critical elements to be readily identified and should minimize biases caused by subjective feelings and interpretations. [Ref. 7] Carson's summary of the EFE Matrix are:

(1) List key external factors identified in the external audit process. List the opportunities first and then the threats, being as specific as possible.

(2) Assign each factor a weight that ranges from 0.0 (not important) to 1.0 (very important). The weight indicates the relative importance of that factor to being successful in the firm's industry.

(3) Assign a 1-4 rating to each critical success factor to indicate how effectively the firm's current strategies respond to the factor. Ratings here are thus company based.

(4) Multiply each factor's weight by its rating to determine the weighted score.

(5) Sum the weighted values for each variable to determine the total weighted score for the organization.

The result of the EFE matrix is a prioritized table representing the most significant drivers of organizational success. This table would be extremely beneficial when determining which environmental factors should have the most influence on the organizations strategic efforts.

3. Assessments of Specific Task Environment

The environment specific to the organization can be described in two areas; key resource controllers and competitors and collaborators [Ref. 4]. Analysis of these two areas allows the organization to separate the industry environment from the organizational specific environment. For instance, most government organizations must justify their budget requests and compete with other organizations for limited funding through a higher headquarters. The relationships these organizations maintain with their higher headquarters may be critical to the funding they receive.

Evaluation of the organizational resource controllers should review, for example, who provides payments, receives payments, or provides discretionary funding. The resource controllers typically include; clients, customers, regulators, and higher management [Ref. 4].

Evaluation of competitors and collaborators should include a review of the forces generated through key competitors and partnerships. The product of the assessment will be identification of the important forces affecting the competitive and collaborative advantages available to the organization [Ref. 4].

The specific task environment is a critical component of the external environment because it allows the organization to identify potential threats and opportunities that are peculiar to their organizations. With this information, the organization can better identify the strategic issues and strategies required to prepare for future changes.

III. RESEARCH METHODOLOGY

A. INTRODUCTION

This chapter describes the methodology and rationale for selecting specific test centers and for selecting interview personnel. The chapter also includes a brief description of the three sample test centers, including their current missions, personnel make up, operating budgets, and levels of technology. A brief description of the Army's Test and Evaluation Command (TECOM) is also provided. The chapter concludes with a summary of the limitations placed on the data analysis due to the methodology employed.

B. TEST CENTER SELECTION

Ideally, the selected test centers should be representative of DoD test ranges, but have roughly similar external environments to allow comparisons between them. This would also simplify the data gathering process. In selecting a test center sample set, the following criteria and rationale were utilized.

(1) Select test ranges within the same service. This criterion allows comparison of data between the test centers and facilitates a manageable data collection effort.

(2) Include test ranges with a broad spectrum of customers. This criterion ensures (or at least implies) a robust external environment.

(3) Include test ranges that are part of the Major Range and Test Facility Base (MRTFB). This criterion results in data that can be subjectively compared with other service test ranges operating under the uniform MRTFB rules.

(4) Ensure that selected test ranges have implemented some form of strategic planning.

A review of the DoD test center organizations indicated that the Army was the only service with a single command overseeing its test ranges. The Army's Test and Evaluation Command (TECOM) became the focus of the sample selection effort because the overarching organization was expected to facilitate the data collection effort and provide a level of common external environmental factors. A review of the TECOM test ranges was completed to determine which ones fit the remaining criteria. A brief description of the Army's Test and Evaluation Command and its test centers is provided here to identify the key differences between their test ranges.

1. Test and Evaluation Command (TECOM)

The Army's Test and Evaluation Command (TECOM) currently falls under the Army Materiel Command (AMC). The AMC develops, buys, and maintains materiel for the Army and has nine major subordinate commands, including TECOM. TECOM is tasked to support the materiel acquisition process by conducting developmental tests for acquisition programs and by verifying the safety of weapon systems. TECOM consists of a headquarters and six test centers: White Sands Missile Range (WSMR), Aberdeen Test Center (ATC), Yuma Proving Ground (YPG), Redstone Technical Test Center (RTTC), Dugway Proving Ground (DPG), and the Aviation Technical Test Center (ATTC). These six test centers execute a combined workload of nearly ten million direct labor hours annually. The TECOM infrastructure includes over 4 million acres of land and over 4.6 billion dollars worth of equipment. Each of the test centers is aligned with a specific test mission and primarily supports the acquisition of those types of weapon systems. Table 1 provides a summary of the mission areas for all six of TECOMs test centers. [Ref. 9]

Table 1. TECOM Test Range Missions

White Sands Missile Range (WSMR)	Aberdeen Test Center (ATC)	Yuma Proving Ground (YPG)	Redstone Technical Test Center (RTTC)	Dugway Proving Ground (DPG)	Aviation Technical Test Center (ATTC)
Air Defense Smart Weap Direct Energy Space Systems Signature Vulnerability Electronics UAV Antennas Navigation Software AI	Fire Control Direct Fire Robotics Vehicles Sensors Transport	Natural Environment Desert (YPG) Tropic (TTS) Arctic (CRTC) Indirect Fire Mines Aviation Air Delivery	Rockets Missiles Propulsion	Chemical Biological Smoke Obscurants	Aviation

LEGEND:
TTS – Tropic Test Center
CRTC - Cold Regions Test Center
UAV – Unmanned Aerial Vehicle
AI – Artificial Intelligence
Weap - Weapons

Under the oversight of the Office of the Director for Operational Test and Evaluation, the DoD establishes common operating rules for a set of 21 test installations, facilities, and ranges. These rules are designed to ensure that those DoD resources deemed critical for providing T&E information to DoD decision makers are focused on DoD support efforts. These 21 installations are referred to as the Major Range and Test Facility Base (MRTFB). [Ref 10] Of TECOM's installations, WSMR, ATC, YPG, and DPG are included in the MRTFB. These four TECOM MRTFB installations were initially chosen as the test subjects for this research because they appeared to meet the screening criteria identified above. However, preliminary research revealed that DPG had limited workload, limited customer base, and a special congressional status that appeared to minimize its strategic planning efforts, so it was subsequently removed from the sample set. A summary description of each of the remaining three ranges is provided below.

2. White Sands Missile Range

The White Sands Missile Range (WSMR), located in the Tuarosa Basin of south central New Mexico, was established in 1945 as White Sands Proving Ground to support testing and development of rocket technology and missile weapons. Encompassing almost 3,200 square miles, the WSMR is the largest military installation in the country. The WSMR's primary mission is the support of missile development programs for DoD, NASA, and private industry. WSMR's unique missile mission and its range mass have combined to provide a high-tech range infrastructure that has facilitated conduct of other types of testing, including directed energy weapons and RF vulnerability. The Electronic Proving Ground located at Fort Huachuca in Arizona is also an activity of WSMR. [Ref. 11]

At the end of fiscal year 1998, WSMR was staffed with 1,950 DoD civilians, approximately 379 military, and 1,390 contract employees, for a total of 3,719 employees [Ref. 12]. The DoD civilian workforce included 539 scientist and engineering positions with 14 doctorate degrees among them. [Ref 13]

In fiscal year 1998, WSMR conducted roughly 4.1 million man-hours of direct work on test projects, with a large portion of the effort occurring in the area of missile development [Ref. 14]. The test center has an annual operating budget of approximately $401M [Ref. 15].

3. Yuma Proving Ground

The Yuma Proving Ground is located in southwest Arizona along the Colorado River and encompasses over 1,300 square miles of rugged desert terrain. The proving

ground consolidates the Army's natural environment testing by incorporating the Cold Regions Test Activity in Alaska and the Tropic Test Center currently in Panama. The proving ground provides a variety of support to Army developers and regularly conducts field tests for artillery, aviation, armor, vehicles, and air delivery systems. The testing of equipment at YPG dates back to the early 1940s, when it was responsible for testing new bridge and watercraft designs on the Colorado River for World War II efforts. [Ref. 16]

At the end of fiscal year 1998, YPG was staffed with 690 DoD civilians, approximately 85 military, and 660 contract employees, for a total of 1,435 employees [Ref. 10]. The DoD civilian workforce education level included 113 bachelor degrees and no doctorate degrees. [Ref. 13] The YPG is Yuma County's largest employer and the largest government consumer of local goods and services [Ref. 17].

In fiscal year 1998, YPG conducted over 1.3 million man-hours of direct work on test projects with over 65% of that occurring in the area of artillery, tanks, and armored vehicles [Ref 14]. The proving ground has an annual operating budget of approximately $131M [Ref 15].

4. Aberdeen Test Center

Aberdeen Test Center (ATC) is located on the east coast in central Maryland. ATC encompasses almost 500 square miles of land and water along the Chesapeake Bay. The test center is co-located with many of the Army's laboratories at the Aberdeen Proving Ground. While the ATC is primarily a vehicle and direct munitions test center, it provides a variety of support functions for acquisition developers. Besides the vehicles courses and firing ranges required to support its core mission, ATC operates multiple high-technology facilities to evaluate hardware such as robotics, maritime systems, and

advanced transportation technology. The ATC was opened in 1918 as the Aberdeen Proving Ground when the Sandy Hook Proving Ground in Fort Hancock, New Jersey was closed due to increasing congestion in the New York Harbor. [Ref 18]

In fiscal year 1998, the ATC had a DoD civilian staff of 994, a military staff of 82, and 435 contract employees, for a total of 1511 employees [Ref. 12]. Of the civilian and military workforce, 243 had Bachelor's degrees and held scientist and engineering positions. Among them, five also held doctorates [Ref 13].

In fiscal year 1998, ATC conducted just under 2.1 million man-hours of direct work on test projects, with a large portion of the effort occurring in the area of ground vehicles and direct fire weapons [Ref 14]. The test center has an annual operating budget of approximately $129M; this does not include costs of base operations, which are funded directly to Aberdeen Proving Ground [Ref 15].

C. TEST CENTER MANAGEMENT INTERVIEWS

The purpose of interviewing test center managers was to determine the process the test ranges were using to develop their strategic plans, with special emphasis on the processes used to characterize and document the external environment. The interviews also were intended to provide a first-hand perspective on each organization's key external environmental factors. Selection of individuals from each of the test centers was based on the position of the individual in the organization and his or her familiarity with the strategic planning process implemented at his or her facility. Preliminary telephone calls to the command staff of each organization indicated that each test center had assigned specific internal activities and personnel to facilitate development of the strategic plans.

One individual from each test center was interviewed regarding the external assessment process their test centers conducted during their strategic planning efforts. All three of these personnel worked in the quality or business planning groups and were key members of the strategic planning teams for each test center.

D. PROGRAM MANAGER INTERVIEWS

Key customers for each of the test ranges were determined to identify commodity areas having the largest impact or influence on each of the ranges. Discussions with these customers were intended to provide subjective trends regarding application of acquisition reform policies on their development programs, with specific emphasis on implications for the test ranges.

The key customers were identified through a review of test center workload by customer type. Figures 2 through 4 provide a graphical representation of the FY98 workload for each range, sorted by the Training and Doctrine Command's mission areas used by TECOM to track workload. The data used to develop these figures are provided in Appendix A and were derived from the OTARDA data call for development of the President's FY 00 budget.

Key customer areas were identified as those whose mission areas exceeded ten percent of each range's total FY98 workload. The resulting areas were then cross-referenced with the Program Executive Offices (PEO) or major commands responsible for those general areas of system development. Table 2 provides a summary of the resulting important customers for each range correlated to a PEO. Once these areas were identified, program management personnel from these PEOs with acquisition knowledge

and test range experience were selected for interview. Five customer interviews were completed with either program managers or assistant product managers for test and evaluation. These interviews were conducted with customers from the Aviation, Combat Service Support, Fire Support, and Close Combat Heavy mission areas.

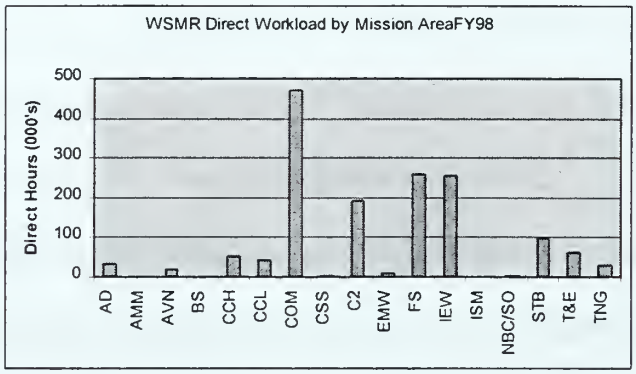

Figure 2. WSMR Primary Mission Areas

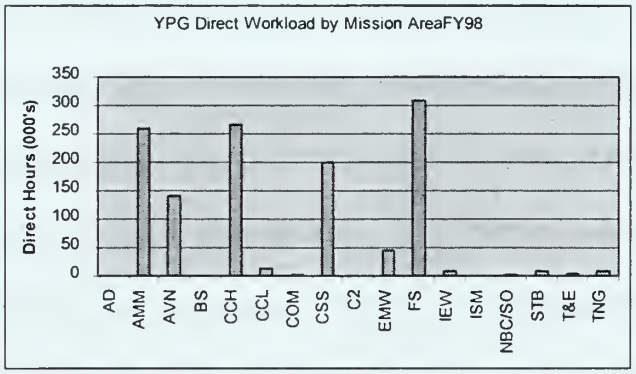

Figure 3. YPG Primary Mission Areas

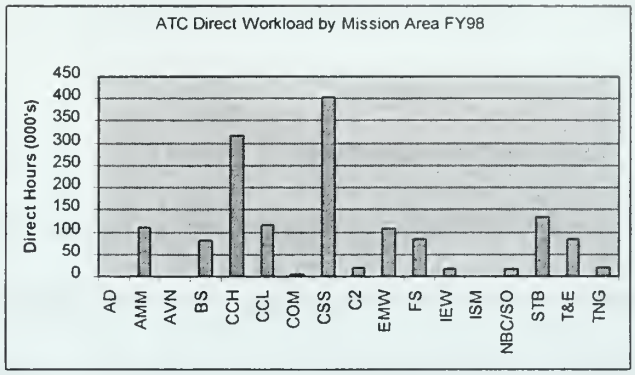

Figure 4. ATC Primary Mission Areas

Table 2. Key Customer Areas by PEO

		Key Customer Area		
TRADOC Mission Area	Primary Proponent PEOs	WSMR	YPG	ATC
Ammunition (AMM)	Industrial Operating Command		X	X
Aviation (AVN)	Aviation, Aviation and Missile Command		X	
Close Combat Heavy (CCH)	Ground Combat and Support Systems		X	X
Communications (COM)	Command Control and Communications Communications and Electronics Command	X		
Combat Service Support (CSS)	Ground Combat and Support Systems		X	X
Command and Control (C2)	Command Control and Communications	X		
Fire Support (FS)	Tactical Missiles	X	X	
Intelligence and Electronic Warfare (IEW)	Intelligence, Electronic Warfare and Sensors	X		
Engineering and Mine Warfare (EMW)				X
Close Combat Light (CCL)				X

E. LIMITATIONS

Due to the methodology used to select the test ranges and interviewees, several limitations must be considered in the analysis of any collected data or their application to

other DoD ranges. These limitations generally fall into the four categories discussed below.

1. Single Service Selection

Selecting only Army test ranges will bias results and subsequent conclusions towards the Army's test range environment. Although the external environment at test ranges is very similar among the services, each has a significantly different system. There was no attempt to identify the strategic planning processes of the Navy or Air Force test ranges. Even with the bias towards Army test range strategic planning, it is likely that the major external influences are common, or at least similar, to all of DoD's open-air test ranges. As such, it may be possible to apply the conclusions and results regarding the future environment to other DoD test ranges, although generality of the sample has not been determined.

2. Customer Relevance

Input from customers was limited to interviews with only five customers from the primary customer base. There was no attempt to statistically quantify trends through large customer surveys. Nor was there an attempt to include smaller customers, even though they may offer the most significant opportunity for future growth. It is also important to note that several of those interviewed are no longer active in the program offices they were selected to represent. These personnel, and their lack of program currency, may not provide a totally accurate portrayal of current customer perspectives on future trends for test center requirements. However, this concern is minimized since all interviewees were either current program mangers or are still active in the acquisition field. Therefore, the customer data set should be used only to identify overarching

changes in customer requirements, and not to focus on specific requirements for each customer.

3. Strategic Planning Interpretation

As Bryson describes it, the *act* of strategic planning is more important than the plan itself [Ref 4]. The strategic plans provided by the test ranges may not incorporate the wealth of information discussed and disseminated during the planning phase. This effect, coupled with the subjectivity of the interviewees' descriptions of the processes, may bias any interpretations of the test ranges' external assessment processes. Thus, the external environmental assessments may understate what was actually discussed in the meetings.

4. Other External Stakeholders

Only the key common external stakeholders are addressed in the independent assessment in the analysis chapter (Chapter VI, Section C), and only brief consideration is given to other stakeholders. Some of these other stakeholders may have significant influence at all of the ranges, but their influence is typically localized to individual ranges. For instance, the local community near ATC exerts a powerful influence over the range because of the community's size, proximity and political strength. ATC has had to deal with noise and environmental complaints from residential areas located near the range boundaries and across the Chesapeake Bay. These residential areas are often made up of powerful politicians who can, and apparently do, present a significant strategic challenge. The local community is a much less significant external influence at WSMR or YPG, which are more isolated and experience less residential encroachment.

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IV. RESULTS

A. INTRODUCTION

The sections below provide a summary of each test center's formal and informal assessment process, assessment results, conclusions, and a summary statement of opportunities and threats. The informal results provide the basis for evaluating the environmental assessment process at each range and for comparison to an independent external assessment in Chapter V.

B. FORMAL EXTERNAL ENVIRONMENTAL ASSESSMENT

(1) Formal Process. The test centers did not implement any formal steps to assess their external environment.

(2) Formal Data Collection. The test centers did not formally collect any environmental data.

C. INFORMALLY DERIVED EXTERNAL ENVIRONMENTAL ASSESSMENT

The strategic planning teams at each of the test centers identified their future vision for each organization. In doing this, the teams discussed the external environment in terms of broad trends and emerging policies. However, the team did not attempt to formally collect or analyze any data regarding the test center's business environment. Based on intuition, experience, information familiarity, and industry knowledge, group discussions identified a set of trends and forces affecting their businesses.

1. White Sands Missile Range

The "facts" and "assumptions" from WSMR's strategic plan provide some insight as to their assessment of the trends and forces affecting their future. They appeared to have identified the general trends and forces outlined in Table 3.

Table 3. WSMR Informal Environmental Assessment Results

Trends and Forces
Increasing competition from training centers
Increasing competition from other test centers
Reputation of high cost facility continuing
Personnel resources declining
Mission requirements decreasing but continuing
Availability of modernization funds decreasing
Increase use of modeling and simulation leads to less field testing

2. Yuma Proving Ground

The discussion area of YPG's strategic plan provide some insight as to their assessment of the trends and forces affecting their future. . They appeared to have identified the general trends and forces outlined in Table 4.

Table 4. YPG Informal Environmental Assessment Results

Trends and Forces
Increasing emphasis on operational testing and training
Reduced RDT&E funding
Reduced grade structure
Increased testing for commercial companies
Customer trend toward using contracts to acquire test expertise
Increasing competition from other test ranges
Decreasing workload
Trend of inadequate modernization funding

3. Aberdeen Test Center

ATC's strategic plan provided some insight as to their assessment of the trends and forces affecting their future. They appeared to have identified the general trends and forces are outlined in Table 5.

Table 5. ATC Informal Environmental Assessment Results

Trends and Forces
Increasing reliance on modeling and simulation
Increasing requirement for technology expertise
Increasing use of partnerships

D. INFORMALLY DERIVED OPPORTUNITIES AND THREATS

The opportunities and threats identified by the test centers are outlined below. These opportunities and threats were derived from both the strategic plans and interviews with test center personnel.

1. White Sands Missile Range

a. Threats

Mission encroachment and competition from training activities and other test ranges are a threat to maintaining viability as a major range and test facility base, and they can drive up costs to customers.

b. Opportunities

(1) Technology provides an opportunity to stay competitive as resources decline.

(2) Emphasis on command, control, communication, computers and intelligence (C4I) provides an opportunity to increase workload if capabilities continue to meet requirements

(3) Integration of testing and training is an opportunity to maximize utilization of capabilities.

2. Yuma Proving Ground

a. Threats

(1) Increased competition is a threat to workload projections.

(2) Reduced resources are a threat to YPG's capability to perform its mission.

(3) Unfunded mandates will threaten already reduced budgets and result in reduced operations and maintenance funds.

(4) YPG's lack of industry exposure threatens the ability to increase market size.

(5) YPG's lack of technology and industry standards expertise may limit attraction of new customers and reduce return customer base.

(6) The poor capital investment process threatens to prevent effective investment in principle customer requirements.

b. Opportunities

(1) Training support provides new market opportunities for YPG capabilities.

(2) Operational testing provides new market opportunities for YPG capabilities.

(3) Commercial research and development agreements provide an opportunity to increase capabilities and exposure to industry at a low cost to the installation.

(4) Partnering with government developers provides the opportunity to demonstrate YPG's credibility and capabilities.

(5) The use of Public/Private Ventures provides the opportunity to increase use of the range's assets and attract high-technology markets.

(6) Safari tests may allow YPG personnel to demonstrate capabilities and credibility to a broad spectrum of potential customers.

(7) Private industry testing may foster the way towards developing industry exposure and new market potential.

3. Aberdeen Test Center

a. Threats

None identified.

b. Opportunities

(1) Maintaining a lead in the development of test standards provides the opportunity to influence industrial and commercial test sectors.

(2) Partnering with other test industry stakeholders allows the opportunity to demonstrate capabilities and increase the effectiveness of the ATC workforce.

(3) Increasing customer focus provides the opportunity to improve customer relations and increases the likelihood of customers returning with additional work.

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V. ANALYSIS

A. EVALUATION OF THE ENVIRONMENTAL ASSESSMENT PROCESS

(1) General Process. None of the test centers conducted formal external environment analyses. However, during the strategic planning process, each utilized expert personnel who offered their opinions and advise on key issues affecting their test centers. The information on the external environment was therefore generated informally as a byproduct of the strategic planning process, not formal steps in the process.

(2) Data Collection Effort.

The ranges made almost no effort to collect external environmental data. The data utilized were limited to workforce feedback, customer feedback, staffing trends and some policy forces. These sources help identify the high-visibility strategic issues, but barely scratch the surface of the test centers' external environment. For example the decreasing workload in close combat heavy was missing as noted in the next section. As a result, they miss many potential opportunities and threats, which, if identified, might allow the center to develop better strategies. If the competitive nature of the test and evaluation industry persists, as the test ranges predict, identifying and addressing the unidentified opportunities could give them a competitive advantage in the future.

B. MY ENVIRONMENTAL ASSESSMENT

Using George Steiner's three-step external audit model [Ref. 8], an executive level external environmental assessment was completed. The results of this assessment

are outlined below and then used for comparison to the test centers assessments identified in Chapter 4, section D.

1. Analyzing The Test Center Customers

a. *Who are the customers?*

Customers of the test ranges are organizations that require test and evaluation support. Customers are primarily military weapon system developers, but small percentages are also from private industry with commercial developments. Over 75% of the workload at TECOM originates from Army developers, while approximately 20% originates from the Navy or Air Force, and about 3% is performed for foreign and private customers.

b. *Why do they buy the product?*

Customers come to the test centers to evaluate the status of their systems and to determine the adequacy of their designs to meet the intended requirements. Many of the customers require large air or land space to allow full field testing of their equipment and have limited options available. The ranges provide large test areas, munitions handling infrastructures, and, sometimes, the expertise required to evaluate system performance.

c. *How will it change?*

Interviews with several customers indicate that the inherently high costs of system-level field-testing has led them to reduce the amount of field testing whenever possible. Up until the mid 1990s, their control over the types and amount of field-testing was limited because of mandatory test requirements and determinations made by other

government agencies. Recent acquisition reform changes have allowed them much more flexibility in determining how much field-testing is required, and they expect to see even less field-testing in the future. Several customers also indicated that acquisition reform changes had allowed them to leverage the expertise of their development contractors to define and execute test programs more efficiently, rather than task engineers at the test ranges.

d. *Are there other potential customers or markets?*

The use of test centers for other than military customers on any large scale is limited by law and policy. For instance, use of the ranges by foreign militaries is restricted by foreign military sale regulations. Providing service directly to foreign companies is not allowed unless they are teamed with a U.S. company, and providing services to commercial U.S activities requires non-competition assessments as well as special contract approval procedures. The ranges primarily cater to developmental testing, but their large open-air ranges may support operational testing and training programs.

2. Analyzing The Test Center Industry

Using Bryson's [Ref. 4] environmental scanning data elements, this industry analysis is subdivided into forces and trends, resource controllers, and competitors and collaborators.

a. Forces and trends

Forces and trends refer to those major forces outside the organization that may impact the success of the test centers. The primary trends and forces influencing all three of the test ranges' future operations are categorized into the broad areas of political, economical, social and technical environments. Each of these areas is outlined below, and current trends are projected from available data.

(1) Political. The political element includes the political system in which the test centers must operate and the pressures and processes that influence the way they operate.

In response to congressional cutbacks, the DoD leadership has attempted to identify sources of cost savings and areas to gain efficiencies. They identified test range and laboratory infrastructure as one such area. Over the past several years, they have implemented several committees, programs, and policies to consolidate the major investment processes and reduce redundancy between the test ranges. These policies and programs represent the crux of the political trends and forces coming from DoD and Congress. The salient points of the key policies and programs are briefly described here.

The Under Secretary of Defense (USD) for Acquisition and Technology sponsored the Foundation Initiative 2010. This initiative identifies core tools and programs test ranges should build their future investments around. The initiative relies on the tools and considerable partnering among the ranges to obtain efficiencies.

While addressing the International Test and Evaluation Association, Dr. Paul Kaminski talked of the requirement to reinvent DoD testing and

evaluation. In his remarks, he commented that "test and evaluation related problems are cited as the major culprit causing many programs to experience excessive schedule delays and enter this downward mischief spiral." [Ref. 20] He went on to explain his expectation that the test and evaluation community will go through a cultural change beginning at the working levels to improve the weapon systems and field them in a shorter period.

In 1997, Kaminski also approved and strongly endorsed a program called Simulation, Test and Evaluation Process [Ref 20]. This program requires the acquisition community to develop and implement simulation and modeling activities to help reduce the quantity of field testing, increase system quality, and facilitate early evaluation.

Also in 1997, Dr. Patricia Sanders, then director of Test, Systems Engineering and Evaluation for the USD A&T, addressed a congressional subcommittee on Military Research and Development. In her remarks, she described the challenging environment the test and evaluation community could expect to see in the future. Her description included: decreasing modernization budgets; fewer resources for engineering and test; fewer investment dollars for enhancing capabilities; and inherently more sophisticated and complex weapon systems. Sanders indicated that the objective of the test ranges and DoDs policies would be to reduce resources, time, and risk associated with fielding systems by teaming, implementation of simulation, leveraging modernization dollars, and enhancing productivity of the test and evaluation facilities. In partial support of the simulation initiatives, Sanders described the work distribution at the test ranges versus developmental costs of weapon systems. In her view, the test ranges accounted for 30% of the acquisition work in DoD, but accounted for 60% of the cost.

She also described how the test range personnel had been reduced by 35%, but that more cuts were required. The thrusts of her comments were to eliminate field-testing through implementation of simulation and additional reductions in personnel. [Ref. 21 and 22]

In summary, there appear to be several recurring themes evolving in the test centers' political arena: reduce field-testing; reduce personnel at the test centers; implement simulation and modeling processes; develop partnerships; and improve timeliness.

(2) Economics. For the test centers, the economic element includes the current system of producing and distributing their services. The primary economic areas affecting the test ranges involve the distribution of work, funds and personnel among them. While these factors are primarily dictated by higher commands, they may ultimately be the result of political forces, and changes may follow political trends. For this analysis they are considered economic factors.

Workload at the ranges is measured in terms of "direct workload" or the number of labor hours provided in direct support of a paying customer. For most of the test centers, direct workload generates income that subsidizes a large percentage of their overhead costs. Figure 6 provides a summary for each test center of the actual workload since FY95 and the projected workload through FY08. The projected workload presented in Figure 5 is derived by TECOM based on historical workload trends and POM estimates for RDT&E programs [Ref. 14]. Appendix A includes complete workload projections by mission area, fiscal year, and test center. These workload estimates are typically used to determine yearly indirect funding for each of the test ranges. The trends depicted for each of the ranges represents a roughly constant workload

from FY99 through fiscal year 2008. Although there are only four years of historical data, they indicate the trends at WSMR may be more volatile than the projections indicate. One limitation of the TECOM projections may be the tendency for customers to do less testing, which would cause these projections to be overstated.

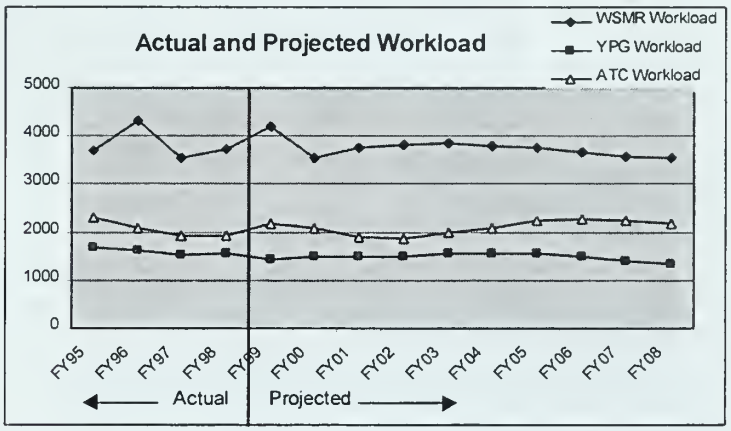

Figure 5. Test Center Workload Projections

Table 6 shows an increased level of workload detail for each of the test ranges by incorporating specific mission areas and the long-term projections associated with these areas. Figure 6 provides a graphical presentation of those mission areas projected to increase. Table 6 and Figure 6 together provide insight as to the growth potential of specific support areas and could help identify specific opportunities for the test centers.

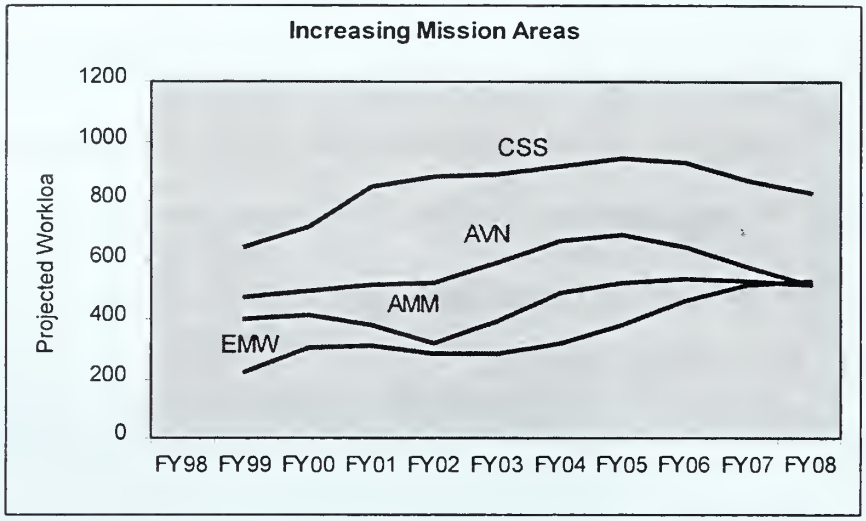

Figure 6. Increasing Mission Areas for TECOM

Table 6. Workload Trends By Mission Area

TRADOC Mission Area	Projected % Change (FY98 to FY08)	Projected Trend	Percent of Total Available Workload in FY98	Percent of Total Available Workload in FY08
EMW	69%	Increasing	3%	10%
AMM	18%	Increasing	8%	10%
CSS	18%	Increasing	12%	15%
AVN	12%	Increasing	10%	9%
AD	6%	Stagnant	2%	2%
FS	0%	Stagnant	14%	14%
C2	-13%	Stagnant	4%	4%
CCH	-23%	Decreasing	14%	12%
CCL	-90%	Decreasing	7%	4%
IEW	-98%	Decreasing	5%	3%
COM	-177%	Decreasing	9%	3%
NBC	NA	NA	1%	1%
BS	NA	NA	2%	2%
Other	NA	NA	10	12

EMW - Engineering and Mine Warfare
AMM - Ammunition
CSS - Combat Support System
AVN - Aviation
AD - Air Defense
FS - Fire Support
C2 - Command and Control
CCH - Close Combat Heavy
CCL - Close Combat Light
IEW - Intelligence and Electronic Warfare
COM - Communications
NBC - Nuclear Biological
BS - Unknown

The TECOM projections for staffing levels at each of the test centers are identified in Figure 7. These projections include the total number of military, civilian, and contract personnel. The projections indicate a general decline at each of the test centers through FY02, even though workload remains fairly constant.

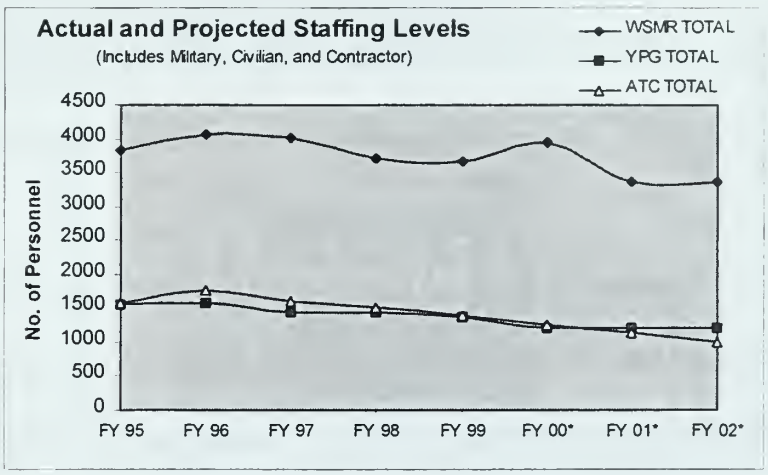

Figure 7. Test Center Projected Staffing Levels

Figure 8 identifies an indicator of the trend towards using contract personnel at the test centers. This trend indicates that, in the future, contract personnel will make up a much larger percentage of the workforce than civilians will. This leads to the conclusion that the reductions in staffing projected by TECOM focus primarily on government civilians.

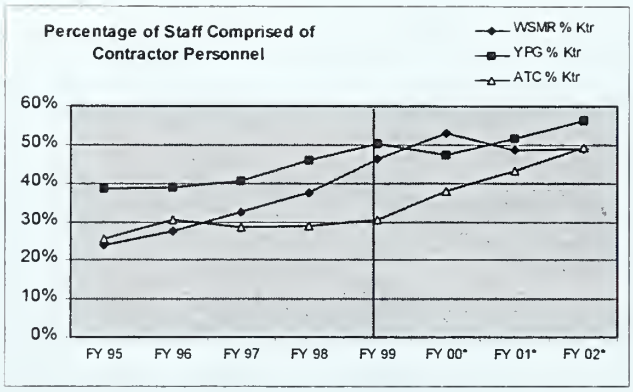

Figure 8. Test Center Contractor Staffing Levels

Funding for the ranges is provided by three major sources: direct funding from customers; improvement and modernization funding; and institutional funding from TECOM. Using TECOM funding forecasts, a funding profile for each of the test centers is provided in Figures 9 through 11. These profiles reflect slightly decreased funding for WSMR and ATC, while YPG's funding profile appears to increase due to an influx of modernization funds.

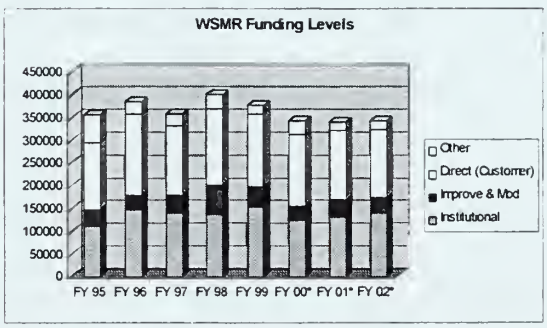

Figure 9. WSMR Funding Profile Forecast

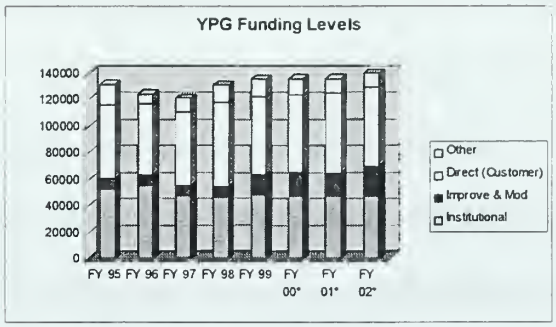

Figure 10. YPG Funding Profile Forecast

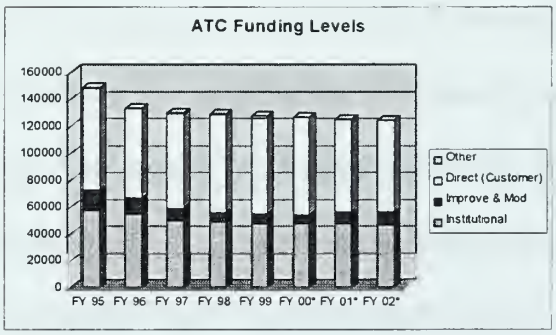

Figure 11. ATC Funding Profile Forecast

The economic trends at the test centers indicate that there will be fewer government personnel and more contract personnel conducting a roughly constant workload. The workload areas may shift, with more focus on combat service support, ammunition, aviation, and engineering and mine warfare, but with less emphasis on close combat, intelligence and electronic warfare, and communications. The funding available to execute this workload will gradually decrease.

(3) Social. The social element includes the norms, beliefs, and behaviors associated with the demographics of a given area or region. Since the ranges are geographically dispersed and have significantly different demographic makeup, this assessment focuses only on the common and broad elements of the social environment,

specifically the trend towards union representation, increased union influence, and U.S cultural norms.

All three of the test centers are seeing their employees increasingly represented by union groups. The centers expect that this trend will continue and that, as the unions begin to represent more personnel across the country, they will have more influence over organizational decisions. Both WSMR and YPG included union representation in their strategic planning sessions, and YPG includes union members on its executive steering council. Increased diversity in the workforce, along with increased public concern for quality of life and environmental issues, may lead to increased demands for flexibility and workplace improvements [Ref. 4].

(4) Technological. Technological elements evolve through breakthroughs in the test and evaluation industry that can change the ability of a test center to support its customers.

Weapon systems developers have seen the technology they apply to their weapon systems become increasingly complex at all levels. Over the past ten years, there have been quantum leaps in computer, communication, sensor, and software capabilities. These technologies are also being horizontally integrated to form increasingly more complex weapon systems. Old systems, such as gravity bombs, were typically stand-alone systems used to meet singular requirements. In today's world of "smart" weapon systems, a system may incorporate elements of many technologies to meet the demands of increased performance and multiple requirements. One other significant technology trend affecting the test centers is the emphasis on simulation and modeling in place of field-testing. According to Dr. Kaminski, then the Under Secretary

of Defense for Acquisition and Technology, DoD expects everyone within the test and evaluation community to ensure that modeling and simulation become an integral part of the acquisition process [Ref 21].

The new technologies not only drive the test and evaluation community to develop increasingly more complex instrumentation systems to assess the weapon systems, but they also require constant academic schooling to maintain current in the new technologies. At the test center level, this becomes harder as the new technologies are rapidly developed and incorporated into weapons system design. The integration of technologies also challenges the test centers to develop capabilities in areas outside of their normal core capabilities. This trend could lead to extra capabilities that generate the opportunity to enter additional customer markets, thus leading to increased competition among DoD's test centers.

One indicator of the test centers' capability to handle the increased technological requirements is found in the education level of the workforce. Figure 12 depicts, for each test center, the historical percentage of the government workforce that has at least a Bachelor of Science degree in an engineering field. This figure indicates that the technical workforce is slowly declining.

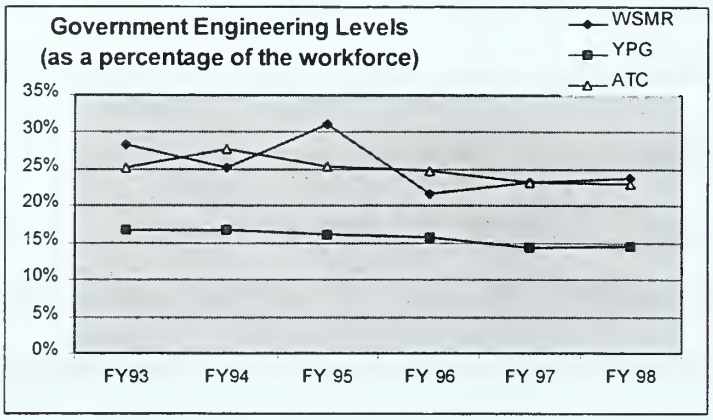

Figure 12. Test Center Engineering Staff

To meet the requirements of rapidly increasing technology, test centers must develop capabilities beyond the scope of their current specialty areas. If the ranges develop additional capabilities they can expect increased competition for test and evaluation work between all the DoD ranges. The ranges face a challenge in maintaining their technology capability given the reduction in staffing and specifically the trend of fewer engineering staff.

b. Resource controllers

The TECOM is the hierarchical resource controller for each of the test centers, and the test customers are the functional resource controllers. However, resources ultimately can be traced to the budget for weapon systems development. The development of weapon systems justifies the core overhead operations at each of the test centers, which is provided through the hierarchical chain of command to TECOM and then distributed to the test centers. The customers are primarily weapon systems developers who use the range's direct services and are the driving force behind the numbers of employees, types of instrumentation, and amount of direct funding the range receives.

The TECOM distributes indirect and modernization funds based on historical indicators and projected performance. The test centers have always been subordinate to TECOM, but with decreases in core operating funding from Congress, the test centers are beginning to become more independent of TECOM. In October 1999, an Army initiative to consolidate testing activities will become effective. As a result of the consolidation, TECOM will become the Development Test Command (DTC) under the Army's Test and Evaluation Command (ATEC). This consolidation changes the entire reporting structure. Prior to this time, TECOM reported directly through AMC to the Vice Chief of Staff of the Army (VCSA). The reorganization results in TECOM reporting directly to what was the Operational Test and Evaluation Command (OPTEC), then the VCSA. This change in reporting structure may result in critical budget reviews and possible reallocation not only of funding resources but also of personnel and equipment resources at all the test centers.

Distribution of customer funds is dependent on competition, capability, reputation, and the past experience each customer has with all the ranges. Since there are limited funds and fewer development programs, the test centers perceive a zero sum gain environment. They perceive a fixed amount of testing can or will be supported by weapon systems developers and that anything they lose is gained by another test centers, or vice versa. These factors and test center parochial interests are fueling intense competition for customer funding.

c. Competition and collaborators

It is evident in the test centers' marketing developments and the resulting customer reactions that competition among the test centers is increasing rapidly. Each of

the test centers is developing marketing programs to identify new and maintain old customer bases. As a result, customers recognized the extent of their alternatives and began issuing bid requests to multiple test centers to identify the best value for their program. Five to ten years ago, this environment was unheard of, and TECOM controlled assignment of test locations. The competitive environment is driving many test centers to redesign their methods of meeting customer expectations and to tailor their products to customer needs.

This competitive environment may be preventing large-scale implementation of OSD-sponsored partnering relationships, but there appears to be a trend towards developing geographical partnerships among the test centers. The southeastern corridor of excellence partnership which has agreed to collaborate on marketing joint capabilities to potential customers. The southeastern corridor of excellence partnership currently includes the Aberdeen Test Center, Redstone Technical Test Center, the Aviation Technical Test Center, and Eglin Air Force Base. Ranges located in the western U.S have a much looser coalition but appear to be moving in the same direction. Whether the coalitions emerge as a competency-based partnership or a geographical marketing effort will be determined by their success in attracting customers and how effectively and efficiently they can meet their needs.

3. Analyzing The Information

a. Test Center Opportunities

The significant opportunities identified through this industry analysis are outlined below. Each opportunity includes a brief description of the industry forces or indicators correlating to the opportunity.

Increased marketing to private industry provides an opportunity to increase workload and maintain low costs to customers through overhead subsidy. Supporting tests for private industry currently represents only a small portion of the total workload. Increasing this market area offers the opportunity to replace declining defense testing.

Using the test center to support operational testing and training activities can provide opportunities to increase utilization of range assets and resources and to reduce operating costs. There is political support for this effort and there is an interest by these activities in these test ranges, so the environment would clearly support and encourage those initiatives.

Early partnering with developers can improve test center reputations, establish test center issues, and improve the service provided to the developers. The test and evaluation community generally suffers from a poor reputation, and there is political support to include testers early to reduce costs, improve performance and reduce time to field.

Partnering with other test centers may allow a center to leverage its core competencies and investment funding to maximize effectiveness and efficiency. While investment spending and staff have decreased, workload has remained constant.

Partnering could allow test centers to leverage their specialties and jointly provide better services instead of becoming "jacks of all trades." The resulting integration of the test centers may allow them to take over some of the test planning functions from the program office.

Incorporation of simulation and modeling capabilities may help test centers regain some of the workload being lost as a result of the use of modeling and simulation. There is a rising trend of implementing modeling and simulation to reduce the requirements for field-testing. This trend is supported in the political environment and has the potential to improve customer support.

There are opportunities to increase the customer base in the Engineering and Mine Warfare (EMW), Ammunition (AMM), Combat Support Systems (CSS), and Aviation (AVN) test support areas. TECOM projections for support in these four areas show the largest growth potential at the Army test centers [See Table 6].

Increased use of a contractor workforce mitigates the impact of lost government staff and engineering resources, while establishing flexibility to respond to dynamic workload changes. Staffing trends indicate that test centers are beginning to rely more on contractor support, who can offer a significant advantage in the areas of workforce size flexibility [See Figure 8].

The YPG has an opportunity to develop a improve their modernization effort. The YPG was the only test center of the three projecting an increase in modernization funding over the next five years [See Figure 10].

Trends indicate that the test centers can expect more competition as the budget becomes tighter and fewer customers require their services. Test centers may be

able to take advantage of the emerging competitive nature if they identify and maintain a competitive advantage.

b. Test Center Threats

The significant threats identified through this industry analysis are outlined below. Each threat includes a brief description of the industry forces or indicators correlating to the threat.

The test centers' customer's tendency to conduct less testing represents a threat to test range infrastructure and the capability to support customers. As customers incorporate non-field test methods of verifying system requirements, the funding used to maintain the infrastructure and the justifications for test personnel will diminish.

The customers' tendency to use test centers less for their test expertise and more as support activities represents a threat to the technical positions and technical capability of the test ranges. As customers begin to take advantage of new policies allowing greater flexibility in how they test their systems, they are beginning to rely more on their development contractors than on test centers for test expertise.

The political environment indicates the test and evaluation community's reputation as high-cost and problematic, threatens its ability to influence development of weapon systems. Policy makers' perceptions of a problematic test and evaluation community may lead to policies that hinder test centers' ability to perform their missions.

The incorporation of simulation and modeling initiatives pose a threat to the test centers' future workload. The use of modeling and simulation is expected to reduce the requirement for field testing at the centers. This reduction in field work may reduce workload, and thus further reduce staffing and available funding.

Decreasing budgets represent a threat to the test centers' ability to perform their mission. The combination of decreasing budgets and constant workload threatens their ability to maintain the resources required to support test requirements for all customers.

The reduction in engineering resources also represents a threat. More-sophisticated technology in both the weapons systems and the instrumentation needed to test them requires significant technical capability. The loss of technical workforce strength may reduce the test centers' ability to meet the emerging technology requirements.

Decreasing modernization funding also poses a threat to the test centers' ability to execute support for their customers. As modernization funding decreases, the test centers are forced to prioritize modernization efforts. As more efforts remain unfunded, the test centers are less prepared to support new test requirements.

There are threats to the customer base in the Close Combat Heavy (CCH), Close Combat Light (CCL), Intelligence and Electronic Warfare (IEW), Communications (COM) test support areas. TECOM projections for support in these four areas show the largest negative growth potential at the Army test centers [See Table 6].

The Army's consolidation of testing under one command poses a threat to funding, staffing and equipment at the Army test centers. The consolidated ATEC could have a negative impact on the ability of the test ranges to support testing if there is a re-distribution of resources among the test centers and operational testers.

Competition represents a significant threat to workload levels at all of the test centers. If the centers do not respond to increases in competition with increases in

efficiency and effectiveness, they will begin to lose workload and see a subsequent loss of personnel and other resources.

C. COMPARISON OF ENVIRONMENTAL ASSESSMENTS

(1) Factors Common to Both Assessments. A comparison of the threats and opportunities determined by all the test centers and my independent assessment indicated there were some common and unique factors among them all. All the opportunities identified by any assessment are presented in Table 7. Each opportunity is associated with the assessment(s) that identified it. The threats are presented in the same manner in Table 8. These tables presents the opportunities and threats that were identified in my assessment or any of the three test center assessments.

Table 7. Opportunities From All Assessments

Opportunities	Independent	WSMR	YPG	ATC
Legislation allows commercial testing	X		X	
Training support trends	X	X	X	
Partnering with developers	X		X	
Support for test center partnering	X			X
Operational test support trends	X			
Increased use of simulation and modeling	X			
Increasing test mission areas	X			
Increased use of contractor support	X			
Increase in YPG modernization funds	X			
Increasing competition	X			
Use of technology		X		
Acceptance of commercial research and development agreements			X	

Table 8. Threats From All Assessments

Common Threats	Independent	WSMR	YPG	ATC
Decreasing Budgets	X	X	X	
Increasing Competition	X	X		
Customer trend of less field testing	X			
Increased use of simulation and modeling	X			
Trend of declining budgets	X			
Trend of reduced engineering resources	X			
Test mission declining areas	X			
Army test command consolidation	X			
Trend towards increasing technology	X			
Trend towards decreasing technical staff	X			

The comparison of the assessments indicates that, even when the results from all the test centers are consolidated, they are incomplete when compared to a methodical structured assessment conducted by a non-expert. This comparison supports the view that without a methodical external environmental assessment the test may miss critical aspects of the external environment. It is postulated that a methodical assessment conducted by a core team of experts from the test centers would produce a much more detailed and accurate depiction of the external environment and, in turn, would be much more valuable to the test centers in their strategic planning efforts than their current informal methods.

It is important to again note that none of the test centers did a dedicated external assessment; nor did they document their round table results, so the generalizations from the strategic plans and interviews may understate the extent of the test centers assessments.

VI. CONCLUSION AND RECOMMENDATIONS

A. CONCLUSIONS

Test ranges are not conducting formal external environmental assessments during their strategic planning processes. Rather, they are relying on opinions and advise from expert personnel during other strategic planning steps. Any external environmental assessment information is generated informally as a byproduct of the strategic planning process. The result is that some opportunities and threats have surfaced, while others with high potential have not been identified.

To meet today's challenging and competitive test and evaluation environment the first and possibly most important step towards implementing effective strategic planning is the development of effective external environmental assessments. The environmental analysis becomes the foundation for the entire strategic planning process. If the test centers continue to base their strategic planning efforts on impressionistic and informal environmental assessments they risk misidentifying or ignoring some critical changes in the test and evaluation industry. Without a more systematic environmental assessment, they will be unable to take advantage of the many opportunities the emerging environment offers, nor prepare for the threats it may present.

B. RESEARCH QUESTIONS

The research addressed a primary research question, as well as several secondary questions. The primary question was: To what extent do existing external environmental assessment efforts at the Army's test centers adequately map the general and task environment?

The secondary questions were:

(1) What is the potential environment for the Army's test centers? What are the emerging trends and forces, and what issues need to be considered?

(2) What external environmental data should be collected and considered? Are there any significant threats or opportunities that are not being addressed by the test centers?

C. RESEARCH QUESTION ANSWERS

(1) *To what extent do existing external environmental assessment efforts at the Army's test centers adequately map the general and task environment?* Using their existing environmental assessment processes, the test centers are able to identify only the top level or highest visibility environmental factors. This limitation prevents the test centers from identifying the more subtle and often more significant factors. Identification of these factors would allow them to develop strategies that are more effective and establish a competitive edge over other test centers.

(2) *What is the potential environment for the Army's test centers? What are the emerging trends and forces, and what issues need to be considered?* The emerging environment at the test centers can be summarized in terms of the opportunities and threats associated with it. Table 9 provides a summary of the opportunities and threats confronting the test ranges. This summary represents the results of the authors external environmental assessment.

Table 9. Emerging Test Center Business Environment

OPPORTUNITIES	THREATS
Legislation allows commercial testing	Decreasing Budgets
Training support trends	Increasing Competition
Partnering with developers	Customer trend of less field testing
Support for test center partnering	Increased use of simulation and modeling
Operational test support trends	Trend of declining budgets
Increased use of simulation and modeling	Trend of reduced engineering resources
Increasing test mission areas	Test mission declining areas
Increased use of contractor support	Army test command consolidation
Increase in YPG modernization funds	Trend towards increasing technology
Increasing competition	Trend towards decreasing technical staff

(3) *What external environmental data should be collected and considered? Are there any significant threats or opportunities that are not being addressed by the test centers?* The test centers do not collect or acquire any external environmental data to support an assessment. The test ranges should include a dedicated effort to methodically collect environment data in the following categories.

a. Analyzing the test center customers in terms of who are they, why do they come, how are they changing, and whether there is potential for other customers.

b. Analyzing the testing industry in terms of trends and forces (political, economical technological, and social), resource controllers (who are they, how are they changing), and competition and collaborators.

The test centers should consider the impact of those factors identified in the independent assessment that are not currently being addressed. The factors not identified by any of the test centers are summarized in Table 10.

Table 10. Opportunities and Threats Not Addressed by the Test Centers

OPPORTUNITIES	THREATS
Operational test support trends	Customer trend of less field testing
Increased use of simulation and modeling	Increased use of simulation and modeling
Increasing test mission areas	Trend of declining budgets
Increased use of contractor support	Trend of reduced engineering resources
Increase in YPG modernization funds	Test mission declining areas
Increasing competition	Army test command consolidation
	Trend towards increasing technology
	Trend towards decreasing technical staff

D. RECOMMENDATIONS

The following recommendations are provided for development of external environmental assessments at Army and DoD test centers.

(1) Test ranges should incorporate methodical external assessments using methods similar to Bryson's. This will provide the detailed, analytical reviews of the opportunities and threats required for effective strategic planning.

(2) A continuous external environmental scanning effort should be incorporated. This effort, which should be an integral part of managers' daily functions, would allow quick response to threats and opportunities as managers see them arise. For instance, an established set of data elements similar to those described in the independent assessment could be regularly monitored for the purpose of identifying trends and their potential affect on the test center.

(3) The test centers should consider sharing their environmental assessments or conducting joint assessments. A joint effort would offer the perspective of multiple viewpoints and a more robust assessment, which ultimately would lead to better strategic planning and the possible identification of opportunities to partner.

(4) The TECOM should consider publishing strategic planning guidance to all their test centers that include a rigorous external environmental analysis. The guidance should mirror a methodical approach like Byrson's.

E. SUGGESTED FURTHER STUDIES

Three areas of additional research are suggested.

(1) Analyze the strategic planning process at the test ranges to identify critical areas of improvement that can facilitate better measurements and implementation.

(2) Correlate the Army results of this thesis to the Navy and Air Force test centers.

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APPENDIX A. WORKLOAD PROJECTION DATA

Appendix A provides historical and projected workload data for each of the 3 test centers studied. The data was derived from the Test and Evaluation Command's financial summary report [Ref. 15]. A key to the mission areas is provided after Table 11.

1. WSMR

Table 11. WSMR Workload Projections

Mission Area	Actual (1000's of Direct hrs)				Projected (1000's of Direct hrs)									
	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08
Air Defense	532	151	68	32	41	33	30	29	33	37	42	43	41	37
Ammunition	1	0	0	1	0	1	0	0	1	1	1	1	1	1
Aviation	24	25	11	21	16	17	18	23	26	26	24	18	12	7
BS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CCH	93	59	30	51	34	29	24	20	21	23	26	30	32	32
CCL	5	12	13	42	38	32	23	24	25	29	34	30	22	16
COM	202	438	170	470	358	384	408	472	471	440	411	320	199	167
CSS	12	10	5	3	4	5	6	6	6	6	6	6	6	6
Command and Control	144	330	243	194	211	230	218	211	207	194	187	183	179	169
EMW	12	15	43	9	28	31	24	21	17	16	19	21	20	18
Fire Support	300	368	375	257	295	302	316	317	340	354	387	422	471	512
IEW	228	158	109	255	166	200	237	278	268	213	169	145	127	117
ISM	0	9	0	0	0	0	0	0	0	0	0	0	0	0
NBC/SO	2	0	5	3	1	0	1	1	3	5	8	11	12	13
STB	25	21	60	98	82	77	68	67	66	67	70	72	72	73
T&E	117	106	94	63	77	79	76	77	77	80	84	87	89	92
Training	15	8	24	31	29	34	34	28	34	28	24	24	25	25
TOTAL	**1712**	**1710**	**1250**	**1530**	**1380**	**1454**	**1483**	**1574**	**1595**	**1519**	**1492**	**1413**	**1308**	**1285**

2. YPG

Table 12. YPG Workload Projections

Mission Area	Actual (1000's of Direct hrs)				Projected (1000's of Direct hrs)									
	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08
Air Defense	5	5	0	0	2	0	0	0	0	0	0	0	0	0
Ammunition	248	165	201	259	147	261	178	185	266	293	304	305	300	294
Aviation	112	137	88	140	81	127	130	148	171	179	171	141	114	90
BS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CCH	250	266	223	266	192	155	118	103	105	118	137	161	183	186
CCL	13	14	16	13	18	16	13	13	13	15	17	14	11	8
COM	1	0	3	2	1	2	3	3	3	3	3	2	1	1
CSS	299	308	183	199	224	260	290	284	286	281	298	274	257	248
Command and Control	0	1	18	1	13	10	9	9	9	8	8	8	8	7
EMW	47	34	71	45	51	69	54	46	39	38	45	51	49	44
Fire Support	344	348	367	309	327	340	353	371	335	294	250	187	136	105
IEW	43	21	2	9	7	6	7	9	8	7	5	4	4	3
ISM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NBC/SO	11	1	12	2	1	2	2	2	4	7	10	13	14	15
STB	21	20	21	10	16	15	13	13	13	13	14	14	14	14
T&E	19	15	8	4	9	6	6	6	6	6	6	7	7	7
Training	0	0	6	8	3	6	5	5	5	5	5	4	4	4
TOTAL	1413	1335	1219	1267	1092	1275	1181	1197	1263	1267	1273	1185	1102	1026

3. ATC

Table 13. ATC Workload Projections

Mission Area	Actual (1000's of Direct hrs) FY95	FY96	FY97	FY98	Projected (1000's of Direct hrs) FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08
Air Defense	0	0	1	0	0	0	0	0	0	0	1	1	1	1
Ammunition	167	102	145	109	118	144	98	102	147	162	168	168	166	162
Aviation	10	3	0	1	0	1	1	1	1	1	1	1	0	0
BS	102	85	80	80	78	53	29	30	28	25	25	23	21	21
CCH	542	474	358	317	289	262	217	184	198	215	233	260	274	267
CCL	160	146	131	117	156	141	112	108	118	132	142	119	92	70
COM	17	20	12	5	10	10	11	13	13	12	11	9	5	4
CSS	400	310	268	405	350	455	507	492	520	524	558	509	483	465
Command and Control	5	49	17	20	18	20	20	20	21	20	20	19	18	15
EMW	76	134	202	108	174	212	205	194	236	280	347	423	451	453
Fire Support	107	114	96	83	88	89	92	95	92	85	82	75	71	69
IEW	16	14	15	17	14	17	20	23	22	18	15	14	12	11
ISM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NBC/SO	5	27	9	17	2	1	2	4	9	16	25	33	38	39
STB	151	144	150	133	147	138	122	120	118	120	125	128	129	131
T&E	63	88	87	85	85	87	83	84	85	88	92	95	98	101
Training	58	25	38	19	26	24	23	22	23	23	19	17	17	17
TOTAL	**1879**	**1735**	**1609**	**1516**	**1555**	**1654**	**1542**	**1492**	**1631**	**1721**	**1864**	**1894**	**1876**	**1826**

LEGEND:	
EMW - Engineering and Mine Warfare	C2 - Command and Control
AMM - Ammunition	CCH - Close Combat Heavy
CSS - Combat Support System	CCL - Close Combat Light
AVN - Aviation	IEW - Intelligence and Electronic Warfare
AD - Air Defense	COM - Communications
FS - Fire Support	NBC - Nuclear Biological
	BS - Unknown

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APPENDIX B. STAFFING LEVEL DATA

Appendix B provides the historical and projected staffing levels of each of the test centers studied. The data was derived from multiple Department of Defense's, In-House RDT&E Activities –Management Analysis Reports.

1. WSMR

Table 14. WSMR Staffing Level Projections

Personnel Category	FY93	FY94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00*	FY 01*	FY 02*
Mil Off Inst			11	8	14	8	6	2	2	2
Mil Off Dir			24	14	3	0	0	0	0	0
Mil Off Other			9	19	16	11	11	9	9	9
TOTAL Mil Off			44	41	33	19	17	11	11	11
Mil Enlist Inst			176	156	90	92	64	39	0	0
Mil Enlist Dir			309	279	231	170	96	65	0	0
Mil Enlist Other			121	193	110	98	45	59	59	59
TOTAL Mil Enlist			606	628	431	360	205	163	59	59
Mil	795	832	650	669	464	379	222	174	70	70
Civ Inst			488	495	589	420	393	390	390	387
Civ Dir			799	808	689	626	589	588	583	576
Civ Other			974	974	955	904	766	693	693	687
Civilian	2340	2357	2261	2277	2233	1950	1748	1671	1666	1650
Ktr Inst			214	200	300	226	247	297	298	300
Ktr Dir			550	666	758	904	988	1063	1065	1075
Ktr Other			142	258	251	260	457	728	275	280
KTR			906	1124	1309	1390	1692	2088	1638	1655
WSMR TOTAL			3817	4070	4006	3719	3662	3933	3374	3375
Total Inst			889	859	993	746	710	728	690	689
Total Dir			1682	1767	1681	1700	1673	1716	1648	1651
Total Other			1246	1444	1332	1273	1279	1489	1036	1035

LEGEND:

Mil – Military
Civ – Civilian
Ktr – Contractor
Inst – Institutional
Dir - Direct
WSMR – White Sands Missile Range

2. YPG

Table 15. YPG Staffing Level Projections

Personnel Category	FY93	FY94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00*	FY 01*	FY 02*
Mil Off Inst			11	9	7	5	3	1	1	1
Mil Off Dir			20	13	6	3	4	2	2	2
Mil Off Other			4	5	5	4	3	3	3	3
TOTAL Mil Off			35	27	18	12	10	6	6	6
Mil Enlist Inst			53	49	49	29	5	2	2	2
Mil Enlist Dir			98	73	35	22	7	7	7	7
Mil Enlist Other			54	58	30	22	17	11	11	11
TOTAL Mil Enlist			205	180	114	73	29	20	20	20
Mil	277	240	240	207	132	85	39	26	26	26
Civ Inst			223	218	175	184	159	159	145	122
Civ Dir			230	227	242	232	230	230	205	175
Civ Other			257	309	312	274	254	220	212	201
Civilian	722	802	710	754	729	690	643	609	562	498
Ktr Inst			94	88	78	64	79	89	89	89
Ktr Dir			450	352	352	430	445	358	362	405
Ktr Other			50	172	158	166	162	120	174	184
KTR			594	612	588	660	686	567	625	678
YPG TOTAL			1544	1573	1449	1435	1368	1202	1213	1202
.										
Total Inst			381	364	309	282	246	251	237	214
Total Dir			798	665	635	687	686	597	576	589
Total Other			365	544	505	466	436	354	400	399

LEGEND:

Mil – Military
Civ – Civilian
Ktr – Contractor
Inst – Institutional
Dir - Direct
YPG – Yuma Proving Ground

3. ATC

Table 16. ATC Staffing Level Projections

Personnel Category	FY93	FY94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00*	FY 01*	FY 02*
Mil Off Inst			9	10	5	3	1	1	1	1
Mil Off Dir			0	0	0	0	0	0	0	0
Mil Off Other			2	2	1	1	1	1	1	1
TOTAL Mil Off			11	12	6	4	2	2	2	2
Mil Enlist Inst			39	32	36	18	4	2	1	1
Mil Enlist Dir			103	89	65	46	8	2	0	0
Mil Enlist Other			28	23	16	14	10	7	7	7
TOTAL Mil Enlist			170	144	117	78	22	11	8	8
Mil	185	168	181	156	123	82	24	13	10	10
Civ Inst			374	362	348	329	320	262	214	160
Civ Dir			609	577	545	537	500	409	334	249
Civ Other			8	132	124	128	126	97	83	81
Civilian	1099	1019	991	1071	1017	994	946	768	631	490
Ktr Inst			76	50	75	72	74	79	79	79
Ktr Dis			325	263	315	290	295	314	314	314
Ktr Other			0	228	65	73	58	83	93	93
KTR			401	541	455	435	427	476	486	486
ATC TOTAL			1573	1768	1595	1511	1397	1257	1127	986
Total Inst			498	454	464	422	399	344	295	241
Total Dir			1037	929	925	873	803	725	648	563
Total Other			38	385	206	216	195	188	184	182

LEGEND:

Mil – Military
Civ – Civilian
Ktr – Contractor
Inst – Institutional
Dir - Direct
ATC – Aberdeen Test Center

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APPENDIX C. EDUCATION LEVELS

Appendix C provides the historical education levels at each of the test centers studied. The data was derived from multiple Department of Defense's, In-House RDT&E Activities –Management Analysis Reports and the Armys 1995 through 1999 MRTFB Installation Financial Summary for WSMR, YPG and ATC .

Table 17. Actual Test Center Education Levels

Actual Engineering and Doctorate Degrees								
			FY93	FY94	FY 95	FY 96	FY 97	FY 98
WSMR	Military	S&E	250	161	201	8	8	21
WSMR	Military	DOC	1	1	1	1	2	2
WSMR	Civilian	S&E	623	629	547	616	606	518
WSMR	Civilian	DOC	12	12	12	13	12	12
WSMR	TOTAL	S&E	873	790	748	624	614	539
WSMR	TOTAL	DOC	13	13	13	14	14	14
YPG	Military	S&E	18	19	0	0	0	0
YPG	Military	DOC	0	0	0	0	0	0
YPG	Civilian	S&E	157	156	154	152	123	113
YPG	Civilian	DOC	0	0	0	0	0	0
YPG	TOTAL	S&E	175	175	154	152	123	113
YPG	TOTAL	DOC	0	0	0	0	0	0
ATC	Military	S&E	12	12	9	8	0	1
ATC	Military	DOC	0	0	0	0	0	0
ATC	Civilian	S&E	305	310	282	290	260	242
ATC	Civilian	DOC	7	7	6	5	5	5
ATC	TOTAL	S&E	317	322	291	298	260	243
ATC	TOTAL	DOC	7	7	6	5	5	5
LEGEND: WSMR – White Sands Missile Range YPG – Yuma Proving Ground ATC –Aberdeen Test Center S&E – Science and Engineering Degrees DOC – Doctorate Degrees								

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APPENDIX D. FUNDING LEVELS

Table 18. Test Center Funding Level Projections

Test Center	Funding Category	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00*	FY 01*	FY 02*
WSMR	Institutional	109,486	145,989	139,647	138,062	153,165	123,529	132,306	138,853
WSMR	Improve & Modernize	39,316	32,762	40,733	63,509	44,033	32,571	37,019	34,382
WSMR	Direct (Customer)	146,302	179,136	151,064	167,325	159,969	155,371	151,093	149,152
WSMR	Other	60,650	25,598	25,819	32,362	19,859	29,497	19,448	20,375
WSMR	**TOTAL**	355,754	383,485	357,263	401,258	377,026	340,968	339,866	342,762
WSMR	(TECOM Allotted)	137,433	132,676	134,603	140,208	161,606	129,241	138,585	143,945
YPG	Institutional	53,086	55,795	47,725	46,974	48,036	47,755	47,111	47,347
YPG	Improve & Modernize	7,375	8,040	7,739	7,521	15,235	17,792	17,498	22,331
YPG	Direct (Customer)	55,538	52,843	54,821	63,164	59,152	57,835	59,983	59,789
YPG	Other	15,469	7,567	11,028	13,471	12,892	12,504	11,185	10,204
YPG	**TOTAL**	131,468	124,245	121,313	131,130	135,315	135,886	135,777	139,671
YPG	(TECOM Allotted)	53,429	51,860	48,274	49,267	51,310	52,045	51,879	51,961
ATC	Institutional	57,117	54,740	49,633	48,533	46,847	47,209	47,347	46,043
ATC	Improve & Modernize	15,593	11,804	9,135	6,923	7,733	6,537	8,552	10,217
ATC	Direct (Customer)	75,492	66,469	70,126	72,811	70,960	72,530	69,133	67,592
ATC	Other	751	466	955	932	2,224	35	35	35
ATC	**TOTAL**	148,953	133,479	129,849	129,199	127,764	126,311	125,067	123,887
ATC	(TECOM Allotted)	42,207	38,665	34,843	35,360	35,105	36,668	34,446	32,719

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